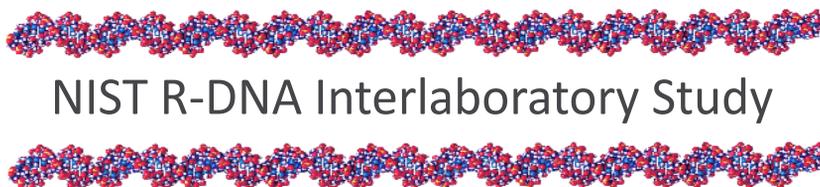


## Please Read

- This talk was presented at the Biometric Consortium Meeting (BCC) held in Tampa, FL on September 18, 2013 in the Rapid DNA Session.
- The data in this talk was intended to provide an update of the progress the R-DNA community and developers have made since the release of prototype R-DNA instruments 12 months prior.
- **The interlaboratory study is not an accurate assessment of Developer A versus Developer B (nor was it intended to be). Each system has specific design and performance differences that are beyond the scope of this presentation. Please contact myself or the specific developer if you have any further questions.**



## NIST R-DNA Interlaboratory Study

Dr. Peter M. Vallone

Leader, Applied Genetics Group

U.S. National Institute of Standards and Technology

**BCC Rapid DNA Session**

September 18, 2013

Tampa, FL

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Disclaimer

- Forensic DNA research conducted at NIST is supported by an interagency agreement between the National Institute of Justice and the NIST Law Enforcement Standards Office.
- Points of view in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Commerce. Certain commercial equipment, instruments, and materials are identified in order to specify experimental procedures as completely as possible.
- In no case does such identification imply a recommendation or endorsement by NIST, nor does it imply that any of the materials, instruments, or equipment identified are necessarily the best available for the purpose.

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Today's talk

- Goals:
  - To disseminate the results of the NIST interlaboratory study for two Rapid DNA (R-DNA) instruments
  - Indicate where we are as a community with R-DNA
- Caveats:
  - **A snapshot of performance (August 2013)**
  - **Not a comparison of developers**
  - **Not a 'stamp of approval' or 'validation'**

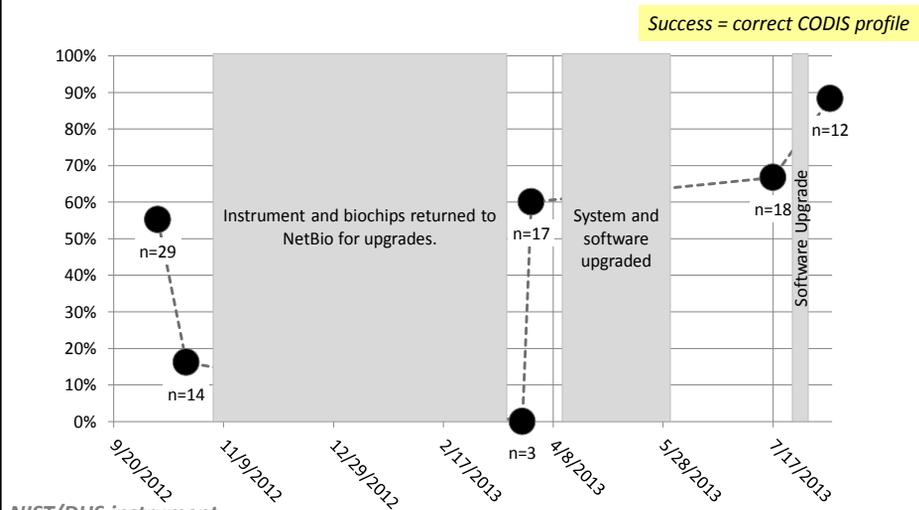
In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Rapid DNA (R-DNA) Prototype Testing

- Received first R-DNA prototypes in Sept 2012
  - ANDE (or DNAscan) (NetBio)
  - RapidHIT 200 (IntegenX)
- R-DNA platforms have been evolving quickly over the last 12 months
- Many developmental changes and upgrades within the past year
  - Software, hardware, data processing, etc

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

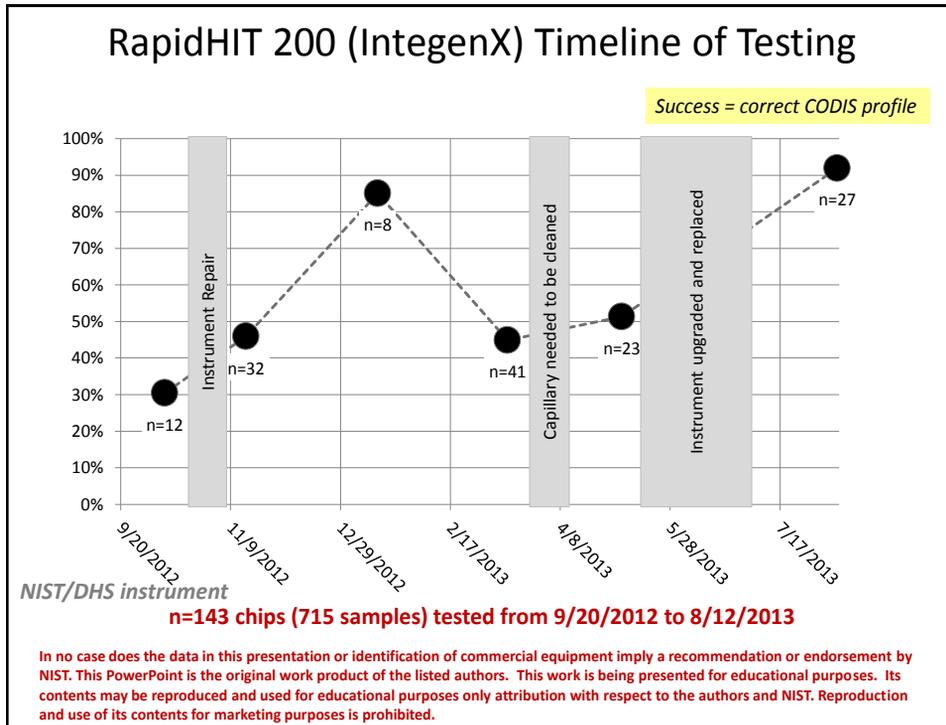
## ANDE (NetBio) Timeline of Testing



**NIST/DHS instrument**

**n=93 chips (465 samples) tested from 9/20/2012 to 8/12/2013**

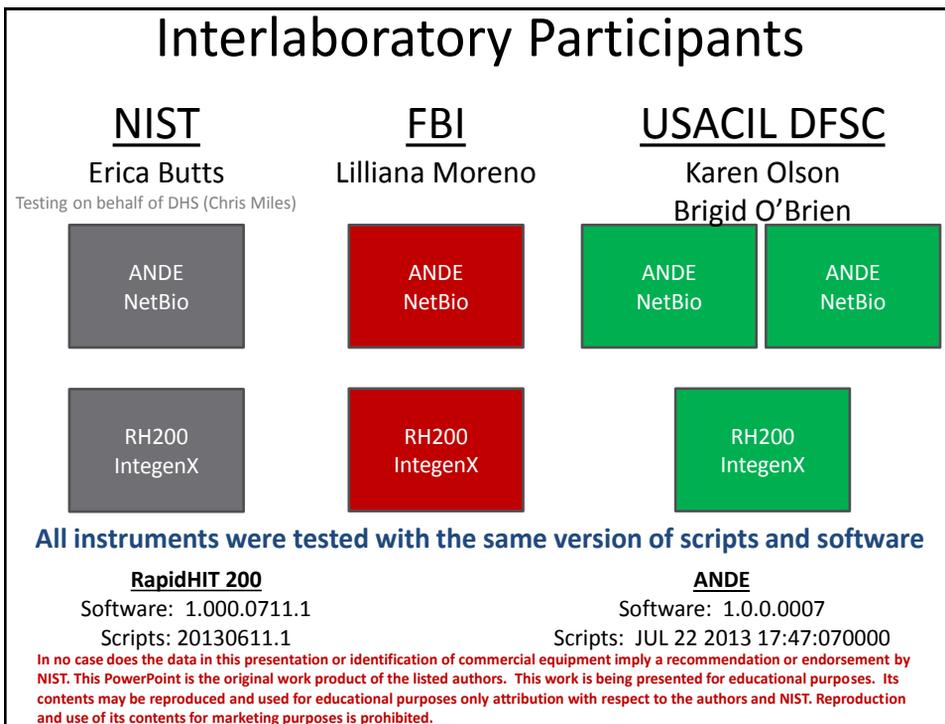
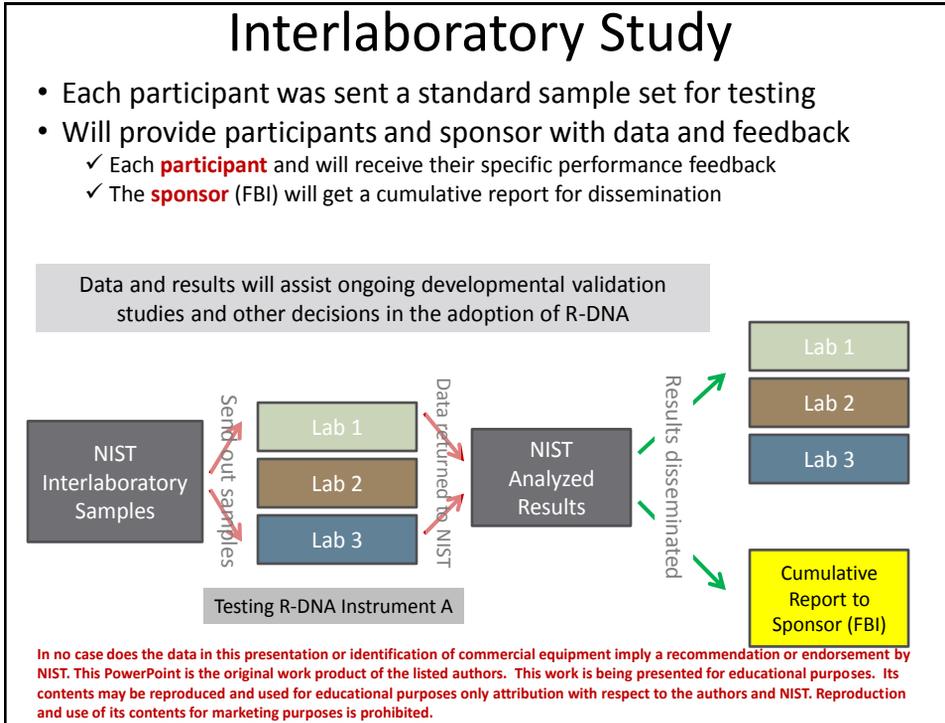
In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.



## Interlaboratory Study

- Success levels (> 80 %) in late July 2013 provided confidence in carrying out a meaningful interlaboratory assessment of the R-DNA prototypes
- Data was collected and analyzed in August 2013
- This is a snapshot in time for the versions of instruments tested
  - Further upgrades may occur for each company

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.



## R-DNA Interlaboratory Testing

- Anonymous buccal collection of 50 samples
  - 5 replicates of 10 unique individuals
  - Swabs were collected 15 months prior to testing
- Schematic of runs (10 chips)

	Chip									
Lane	1	2	3	4	5	6	7	8	9	10
1	A	F	J	E	A	C	F	H	D	I
2	B	G	I	D	B	E	F	J	E	J
3	C	H	H	C	B	D	G	J	A	F
4	D	I	G	B	A	D	G	I	B	G
5	E	J	F	A	C	E	H	I	C	H

Samples sent out July 15<sup>th</sup> all data returned by August 16<sup>th</sup>

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Defining Success

- A complete and correct CODIS 13 locus profile
  - As called by the expert system software
  - If any of the 13 loci allele calls were incorrect or absent this was deemed a lane failure
  - Comparing correct genotypes (lab generated) to the types exported to cmf

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

# Run logs and heat maps

Information is recorded, logged, and reported

NIST, FBI, DFSC developed the worksheets and scoring rules

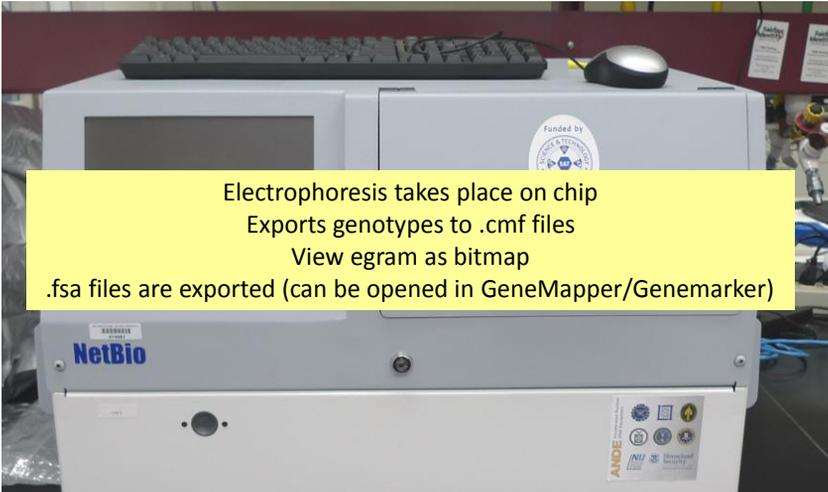
Chip #	Loc	Expected Profile ID	D1S11D8	TH01	D21S11	D18S51	Prmt1	D5S818	D13S117	D7S1228	D16S539	CFP1D1	Prmt2	AMEL	VWA	DBP112F	TPOX	FGA	13 Case	1500N Acceptance	PP3B Acceptance
1	1	A																		100%	75%
	2	B																		100%	100%
	3	C																		100%	100%
	4	D																		100%	100%
	5	E																		100%	100%
2	1	F																		100%	100%
	2	G																		100%	100%
	3	H																		100%	100%
	4	I																		100%	100%
	5	J																		100%	100%
3	1	J																		100%	100%
	2	I																		100%	100%
	3	H																		100%	100%
	4	G																		100%	100%
	5	F																		100%	100%
4	1	E																		100%	100%
	2	D																		100%	100%
	3	C																		100%	100%
	4	B																		100%	100%
	5	A																		100%	100%
5	1	A																		100%	100%
	2	B																		100%	100%
	3	B																		100%	100%
	4	A																		100%	100%
	5	C																		100%	100%
6	1	C																		100%	100%
	2	E																		100%	100%
	3	D																		100%	100%
	4	D																		100%	100%
	5	F																		100%	100%
7	1	F																		100%	100%
	2	J																		100%	100%
	3	G																		100%	100%
	4	G																		100%	100%
	5	H																		100%	100%
8	1	H																		100%	100%
	2	J																		100%	100%
	3	J																		100%	100%
	4	I																		100%	100%
	5	I																		100%	100%
9	1	D																		100%	100%
	2	E																		100%	100%
	3	A																		100%	100%
	4	A																		100%	100%
	5	A																		100%	100%

Each cell represents a comparison between the known genotype and the R-DNA generated genotype

We have developed a key for calling each locus  
 Green = correct call  
 Yellow = partial call (one allele missing)  
 Red = no data  
 Blue = extra alleles, artifact alleles called  
 Black = incorrect alleles called

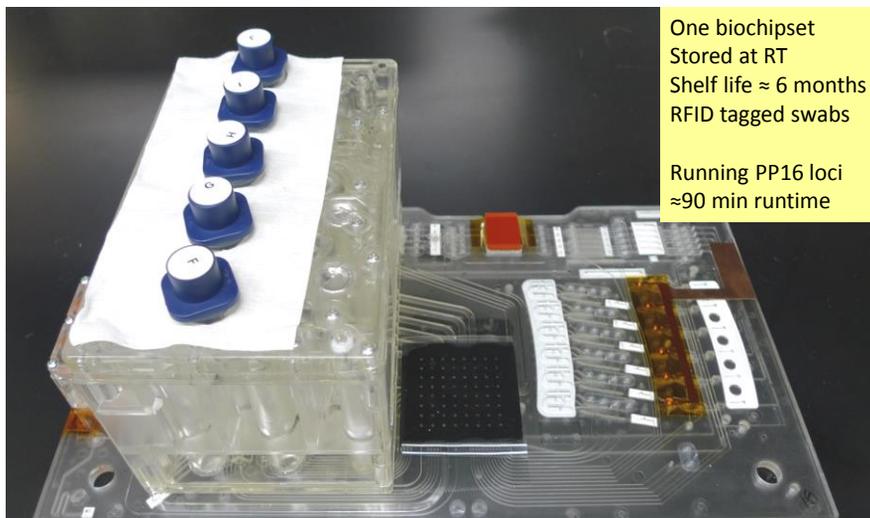
In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## ANDE (NetBio)



In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

# ANDE (NetBio)

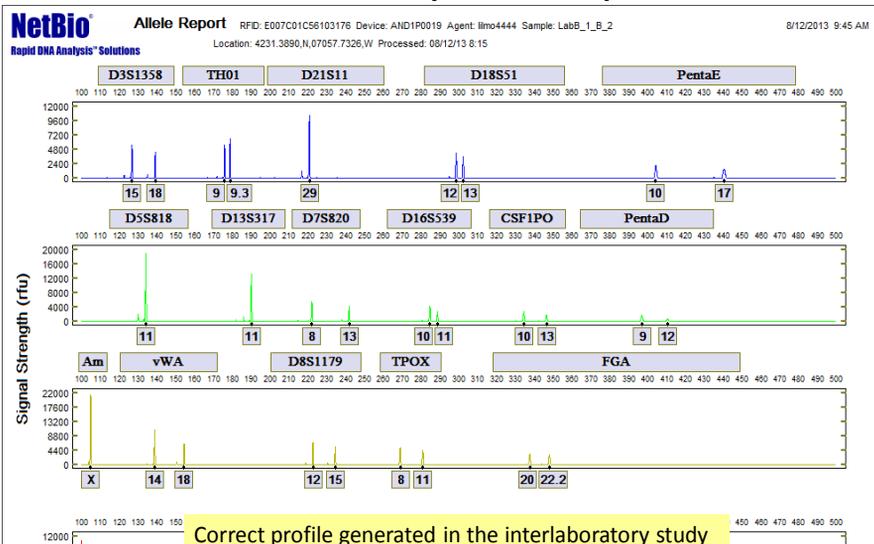


One biochipset  
 Stored at RT  
 Shelf life ≈ 6 months  
 RFID tagged swabs

Running PP16 loci  
 ≈90 min runtime

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

# ANDE (NetBio)



In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## ANDE Summary

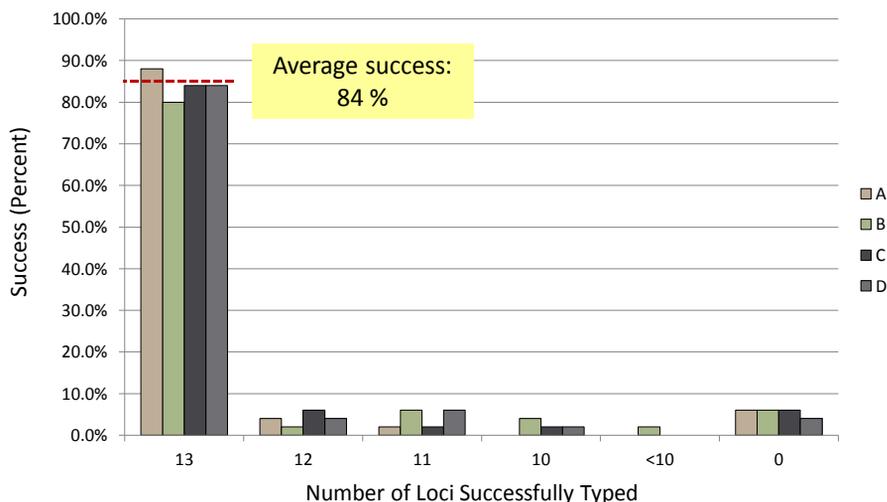
- Following data reflects **only the samples run for the NIST Interlaboratory Study**
- 4 Instruments typed 50 anonymous buccal swabs
  - 5 replicates of 10 unique individuals
- **Total of 200 samples evaluated**
- Study was performed on the same lot of manufacturer biochipsets

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

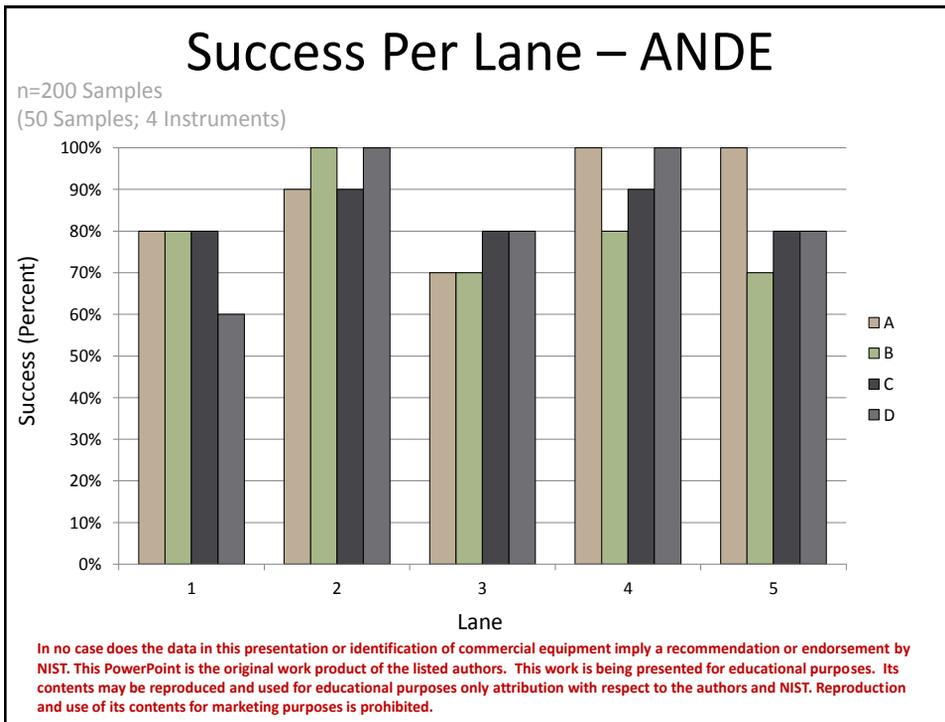
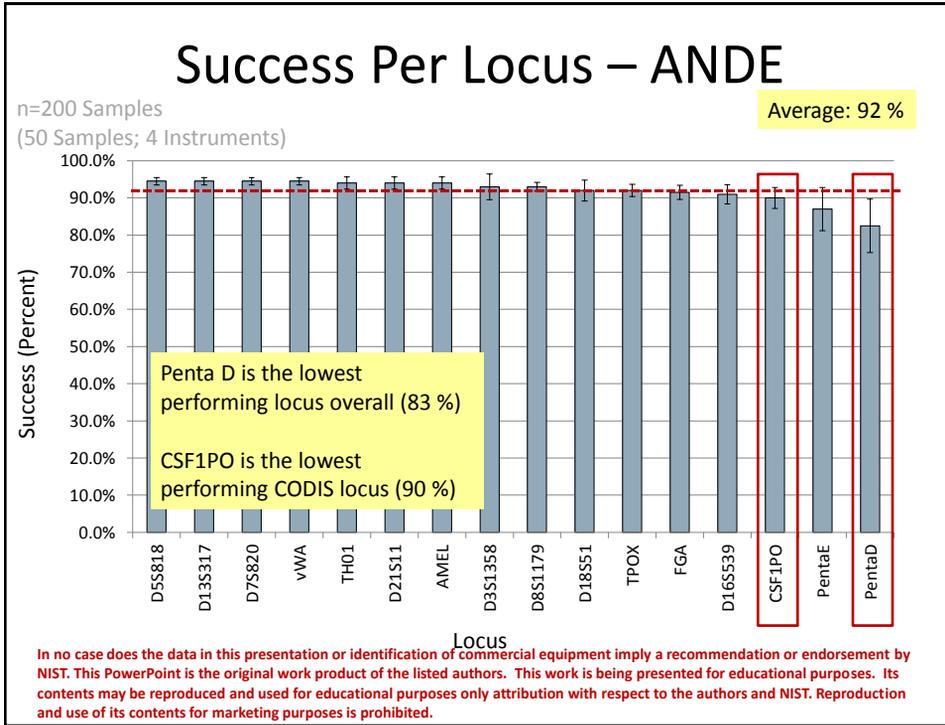
## Successful 13 CODIS locus profile

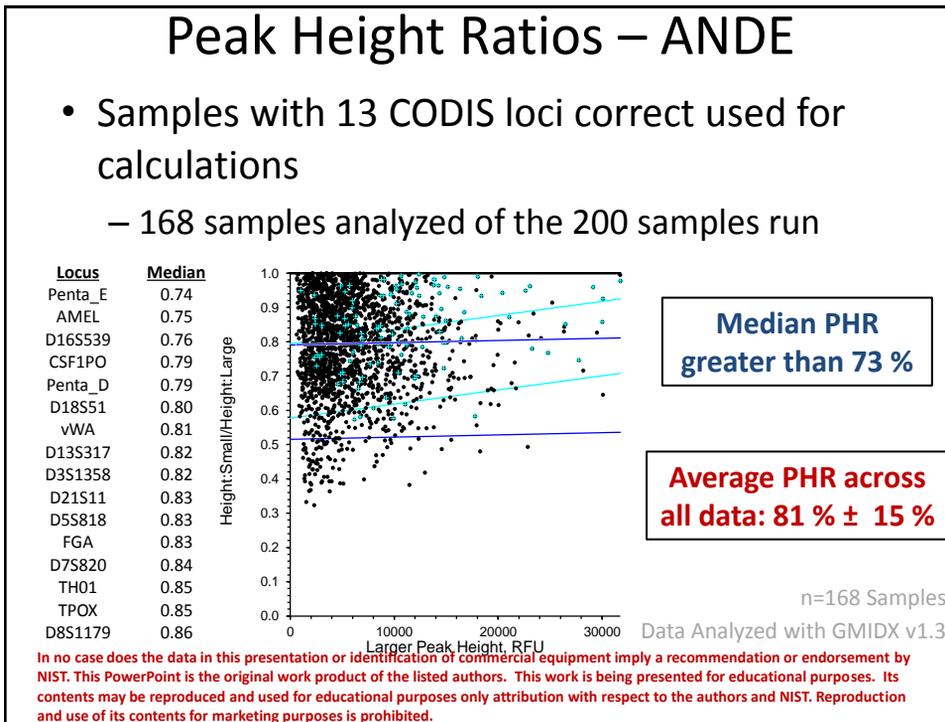
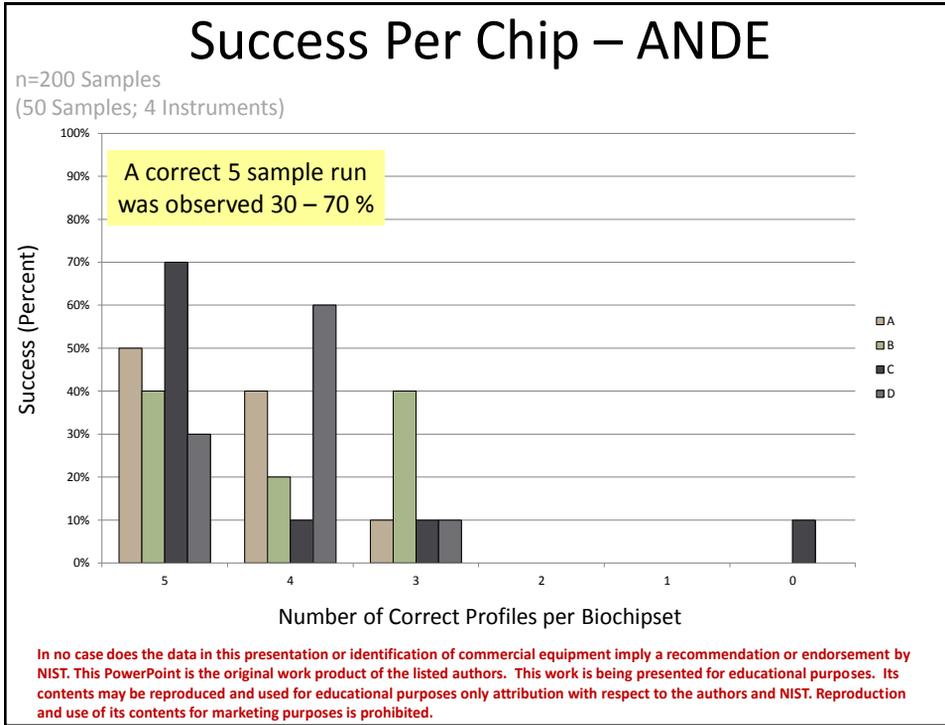
n=200 Samples  
(50 Samples; 4 Instruments)

### ANDE



In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

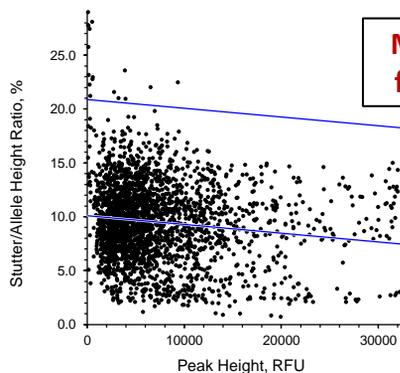




## Percentage Stutter – ANDE

- Samples with 13 CODIS loci correct used for calculations
  - 168 samples analyzed of the 200 samples run

Locus	Median
TH01	2.8
Penta_D	3.3
TPOX	4.2
D7S820	7.5
Penta_E	8.1
D8S1179	8.6
D18S51	8.7
D13S317	9.2
FGA	9.4
D16S539	10.3
D5S818	10.3
CSF1PO	10.5
vWA	10.7
D3S1358	12.5
D21S11	13.5



n=168 Samples  
Data Analyzed with GMIDX v1.3

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Summary – ANDE (NetBio)

- A total of 200 samples were run as part of the study on 4 separate instruments
  - 168 samples provided full concordant CODIS 13 profiles
- 84 % success observed for the 13 CODIS loci
- Average peak height ratio of 81 %
- Median stutter ranged from 3 % to 14 %

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## RapidHIT 200 (IntegenX)



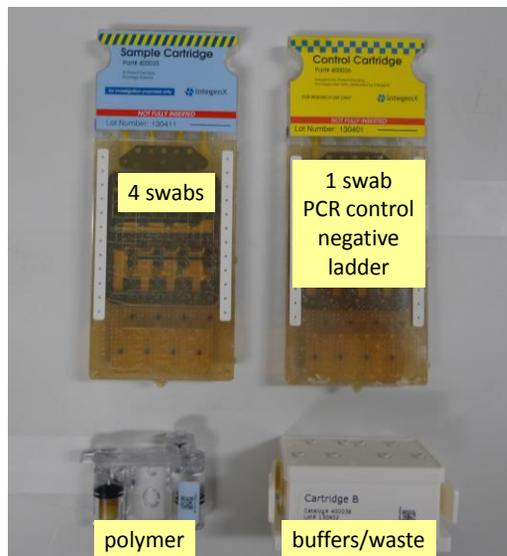
Electrophoresis takes place on an 8 capillary array  
Exports genotypes to .cmf files  
Review data in GeneMarker, .fsa files

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## RapidHIT 200 (IntegenX)

Kit = 4 components  
Stored at 4°C  
Shelf life ≈ 3 months  
Cotton swabs

Running PP16 loci  
≈108 min runtime



4 swabs

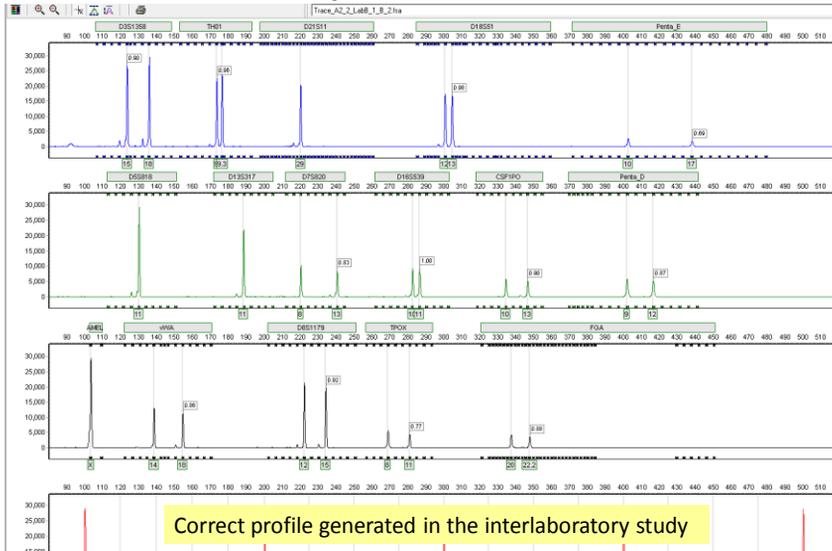
1 swab  
PCR control  
negative  
ladder

polymer

buffers/waste

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## RapidHIT 200

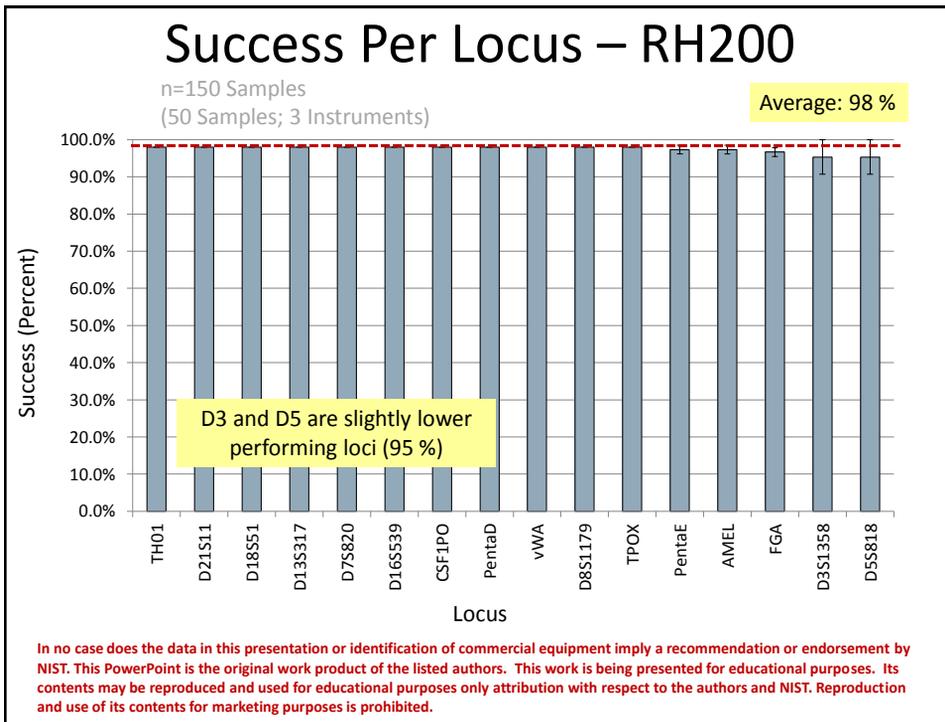
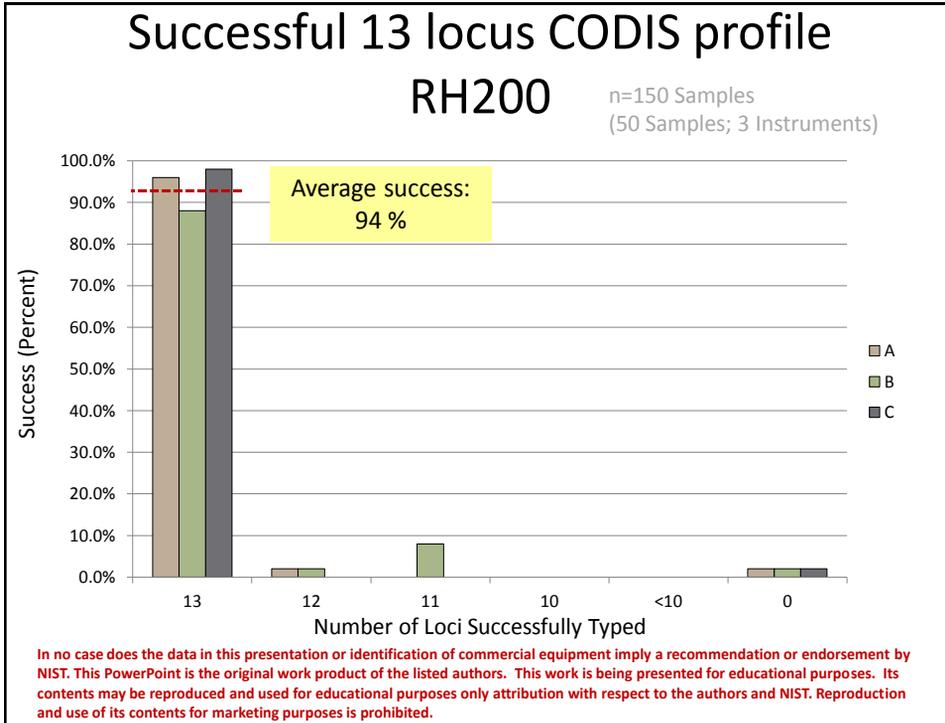


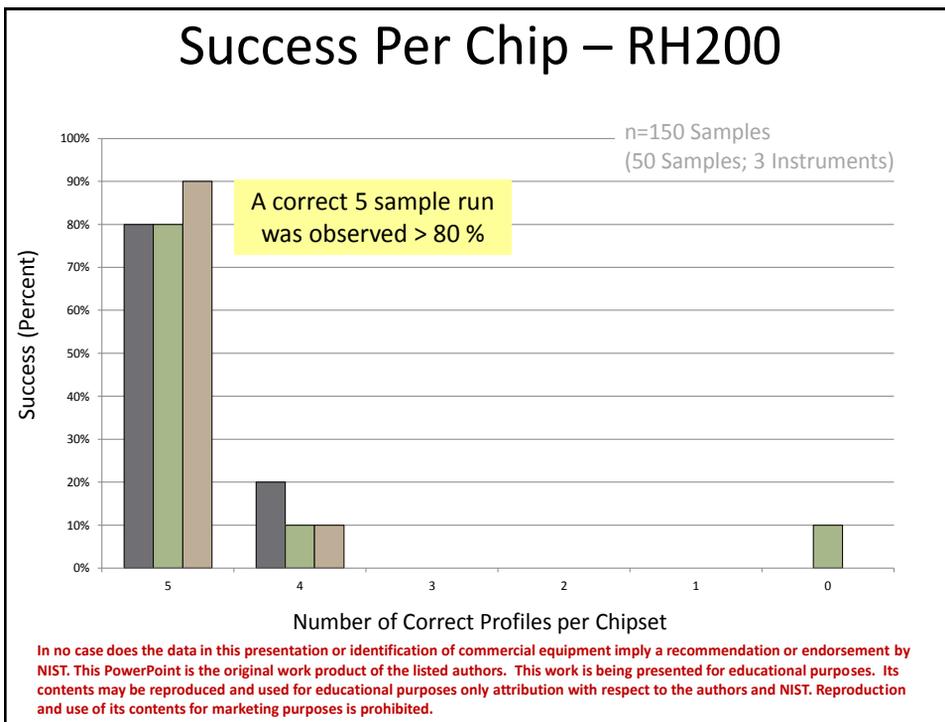
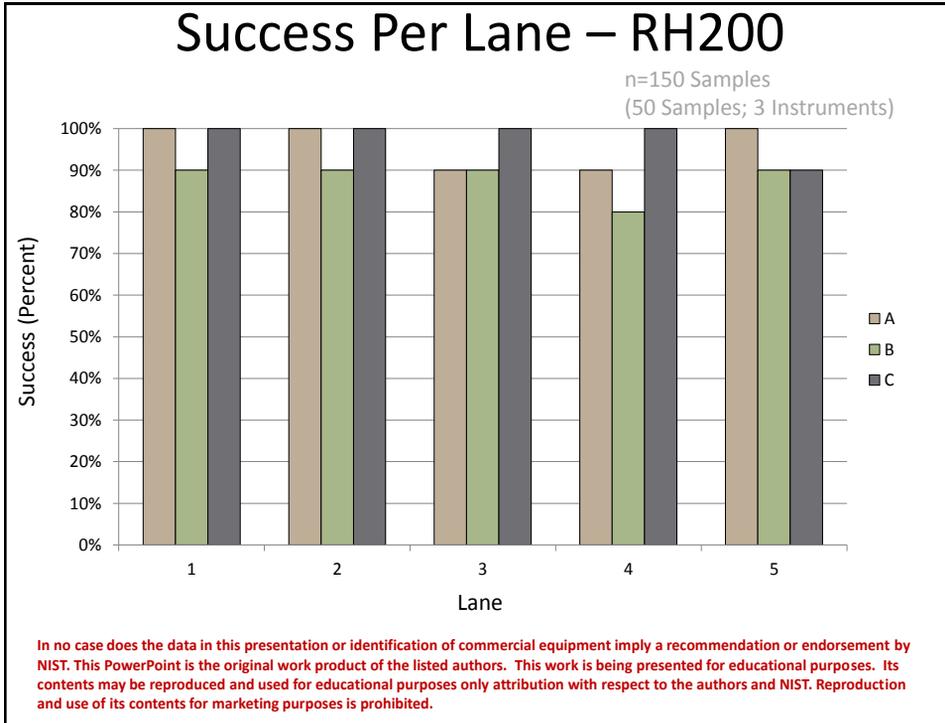
In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## RapidHIT 200 Summary

- Following data reflects **only the samples run for the NIST Interlaboratory Study**
- 3 Instruments ran 50 anonymous buccal swabs
  - 5 replicates of 10 unique individuals
- **Total of 150 samples evaluated**
- Testing was performed over 4 unique manufacturer chip lots

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

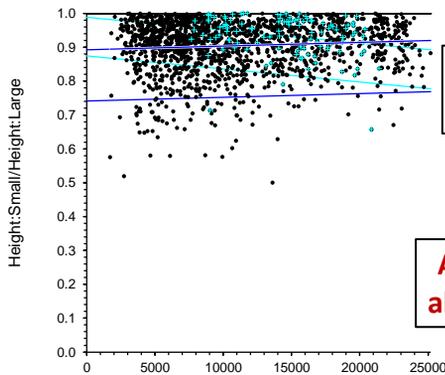




## Peak Height Ratios – RH200

- Samples with 13 CODIS loci correct used for calculations
  - 141 samples analyzed of the 150 samples run

Locus	Median
Penta_E	0.82
Penta_D	0.90
FGA	0.91
D21S11	0.91
D18S51	0.92
D16S539	0.92
CSF1PO	0.92
D7S820	0.92
vWA	0.92
TPOX	0.92
D5S818	0.93
D8S1179	0.93
D13S317	0.94
AMEL	0.94
D3S1358	0.94
TH01	0.95



**Median PHR  
greater than 82 %**

n=141 Samples

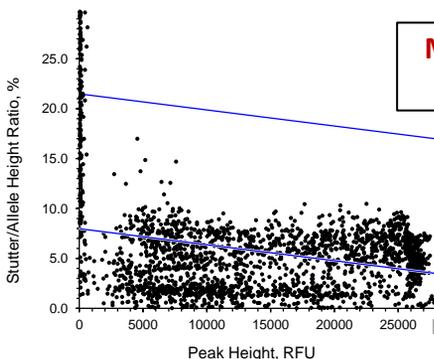
**Average PHR across  
all data is 92 % ± 7 %**

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Percentage Stutter – RH200

- Samples with 13 CODIS loci correct used for calculations
  - 141 samples analyzed of the 150 samples run

Locus	Median
Penta_D	1.5
TH01	1.5
TPOX	2.0
Penta_E	2.2
D7S820	3.9
D13S317	5.0
D8S1179	5.2
D5S818	5.3
D16S539	6.0
D18S51	6.2
CSF1PO	6.2
D21S11	7.0
FGA	7.5
D3S1358	7.6
vWA	7.9



**Median stutter range  
from 1.5 % to 7.9 %**

n=141 Samples

Data Analyzed with GMIDX v1.3

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Summary – RH200 (IntegenX)

- A total of 150 samples were run as part of the study on 3 separate instruments
  - 141 samples provided full concordant CODIS 13 profiles
- 94 % success observed for the 13 CODIS loci
- Average peak height ratio of 92 %
- Median stutter ranges from 2 % to 8 %

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

## Summary

- Where are we at with R-DNA?
  - Fully integrated instruments capable of generating a DNA profile in less than 2 hours
  - Substantial improvements have been observed over the last 12 months
- Combined R-DNA Interlaboratory Results: **88% Success**
  - 309/350 samples correctly typed for CODIS 13 loci
- **If sustained**, success levels are high enough to perform developmental validation studies once hardware and software versions are finalized

In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.

# Thanks for your attention!

## Questions?

Peter.Vallone@nist.gov

301-975-4872

## Acknowledgements

**Erica Butts**, Dave Duewer (NIST), Lilly Moreno (FBI)  
Karen Olson and Brigid O'Brien (USACIL DFSC)  
Chris Miles (DHS), Tom Callaghan (FBI)

### Funding:

FBI - Evaluation of Forensic DNA Typing as a Biometric Tool

DHS – Support of Rapid DNA Testing

**NIST Disclaimer:** Certain commercial equipment, instruments and materials are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or it imply that any of the materials, instruments or equipment identified are necessarily the best available for the purpose.

**Points of view are those of the presenters** and do not necessarily represent the official position of the National Institute of Standards and Technology or the U.S. Department of Justice.

**In no case does the data in this presentation or identification of commercial equipment imply a recommendation or endorsement by NIST. This PowerPoint is the original work product of the listed authors. This work is being presented for educational purposes. Its contents may be reproduced and used for educational purposes only attribution with respect to the authors and NIST. Reproduction and use of its contents for marketing purposes is prohibited.**

